Reviews

The Aftonian Gravels and Their Relations to the Drift Sheets in the Region about Afton Junction and Thayer. By SAMUEL CALVIN. (*Proceedings of the Davenport Academy of Sciences*, Vol. X, 31 pages, 1905.)

In this small brochure Dr. Calvin presents the results of an excellent and much-needed re-study of the type locality for the Aftonian. It will be remembered that, when Chamberlin in 1895 proposed a classification of American glacial deposits, he named one of the important interglacial epochs from certain beds occurring at Afton in southwestern Iowa. These beds were correlated with others in eastern Iowa and in Minnesota, and assigned to the interval between the Iowan and Kansan glacial periods. When the Iowa Geological Survey took up the study of the drift deposits, it was very shortly determined that the lower drift of eastern Iowa was the upper drift of southwestern Iowa, and presumably the one to which the term "Kansan" should be applied. This being so, the beds at Afton must represent a pre-Kansan rather than a post-Kansan period of deposition; and if they were truly interglacial, any drift below them represented an earlier glacial interval than any at that time recognized in the region. Ten years ago, belief in the complexity of the glacial period was not so unanimous as now, and there was some hesitancy in taking so radical a step as was involved in the recognition of an additional glacial advance. In the years which have since passed, the pre-Kansan has been widely recognized, and its existence is now fully established.

In 1898, when the reviewer studied the Aftonian localities, certain of the exposures were obscure, and the evidence was confusing, so that it was thought wiser to make no certain deductions as to the exact relations of the Aftonian to the Kansan. Professor Calvin has been so fortunate as to be able to study new exposures which completely explain the puzzling irregularities noted before, and which leave no doubt of the Aftonian marking a true interglacial interval separating the pre-Kansan from the Kansan by a notable period of time. Mr. Savage had already shown from paleo-botanic evidence[1] that the correlation of the beds at Afton with

[1] *Proceedings of the Iowa Academy of Sciences*, Vol. XI, pp. 103–9.

those at Oelwein in northeastern Iowa was correctly made, so that now there is satisfactory evidence for almost the whole of the story. Whether the pre-Kansan drift is entirely covered by the Kansan, or at some point has a surface development beyond the margin of the latter, is not entirely settled, though the observations of recent years tend to support the view that the pre-Kansan represents only an incomplete advance of the ice and was wholly overridden by the Kansan, representing the maximum advance.

H. FOSTER BAIN.

Economic Geology of the Bingham Mining District, Utah. By JOHN MASON BOUTWELL. With a Section on Areal Geology by ARTHUR KEITH, and an Introduction on General Geology by SAMUEL FRANKLIN EMMONS. (Professional Paper No. 38, U. S. Geological Survey.) Pp. 1–413, 49 plates, 9 figures.

General.—The sedimentary rocks, which are all of the Upper Carboniferous system, consist of 10,000 feet of quartzite containing eight limestone beds aggregating 2,100 feet in thickness. They are cut in many places by intrusive monzonite and younger extrusive andesite. The ores of the region occur in veins cutting all rocks, in beds in the limestone, and disseminated through the monzonite.

Genesis of ores.—The ores may be grouped into three classes: copper ore in monzonite, the lode ores, and copper sulphides in limestone.

1. Copper ore in monzonite.—A relation appears between the amount and quality of the ore, and the degree of alteration of the including rock, suggesting a secondary origin for the ore. Microscopic examination showed the ore to be imbedded in secondary quartz and sericite, proving its secondary origin. The conclusion follows that the copper was deposited from hot solutions in the monzonite after its solidification.

2. The lode ores.—These are confined to fissures. Hot aqueous solutions rose through great northeast-southwest fissures, altered the country rock somewhat, and deposited the lode ores in largest bodies between limestone walls, mostly by filling, but slightly by replacement. The solution was rich in carbon dioxide and sulphur, and a slight solvent of limestone, as shown by the presence of much calcite in connection with the ore, by the great bodies of sulphides deposited, and by the displacement of some of the limestone by the ore. Deposition was aided by decrease in pressure, by the varying slope of the fissures, by contact with limestone, and probably by the material displaced from the limestone.